WRDC-TR-90-8007
Volume V
Part 16

INTEGRATED INFORMATION SUPPORT SYSTEM (IISS)
Volume V - Common Data Model Subsystem
Part 16 - Neutral Data Manipulation Language (NDML) Precompiler Select Internal Schema Access Path Product Specification

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This document establishes the design of Function PRE6, "Select IS Access Path" one of the major functions of the Configuration Item "Precompiler" to be built and formally accepted by the ICAM program office.

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Vol V - Common Data Model Subsystem

Part 16 - Neutral Data Manipulation Language (NDML) Precompiler Select Internal Schema Access Path Product Specification

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FOREWORD

This technical report covers work performed under Air Force Contract F33600-87-C-0464, DAPro Project. This contract is sponsored by the Manufacturing Technology Directorate, Air Force Systems Command, Wright-Patterson Air Force Base, Ohio. It was administered under the technical direction of Mr. Bruce A. Rasmussen, Branch Chief, Integration Technology Division, Manufacturing Technology Directorate, through Mr. David L. Judson, Project Manager. The Prime Contractor was Integration Technology Services, Software Programs Division, of the Control Data Corporation, Dayton, Ohio, under the direction of Mr. W. A. Osborne. The DAPro Project Manager for Control Data Corporation was Mr. Jimmy P. Maxwell.

The DAPro project was created to continue the development, test, and demonstration of the Integrated Information Support System (IISS). The IISS technology work comprises enhancements to IISS software and the establishment and operation of IISS test bed hardware and communications for developers and users.

The following list names the Control Data Corporation subcontractors and their contributing activities:

SUBCONTRACTOR	ROLE
Control Data Corporation	Responsible for the overall Common Data Model design development and implementation, IISS integration and test, and technology transfer of IISS.
D. Appleton Company	Responsible for providing software information services for the Common Data Model and IDEF1X integration methodology.
ONTEK	Responsible for defining and testing a representative integrated system base in Artificial Intelligence techniques to establish fitness for use.
Simpact Corporation	Responsible for Communication development.
Structural Dynamics Research Corporation	Responsible for User Interfaces, Virtual Terminal Interface,and Network Transaction Manager design, development, implementation, and support.
Arizona State University	Responsible for test bed operations and support.

SECTION 1

SCOPE

1.1 Identification

This specification establishes the design of Function PRE6, "Select IS Access Path", one of the major functions of the Configuration Item "Precompiler" to be built and formally accepted by the ICAM Program Office. This CI constitutes one of the subsystems of the Common Data Model Processor (CDMP).

1.2 Functional Flow

The purpose of this Computer Program Configuration Item (CPCI) is to select an internal schema access path through a CODASYL database to satisfy an NDML subtransaction request.

The following functions will be performed by the CPCI:

1. Determine if a calc key search of the database is possible.

2. Determine if an area sweep of the database is required.

3. Construct the optimal access path through the database in generic access path specification code terms using data from the internal schema tables.

SECTION 2

DOCUMENTS

2.1 Reference Documents

1. ICAM Documentation Standards: IDS15012000A, 28 December 1981.

2. D. Appleton Co., CDM Administrators Manual: UM620141000, March 1984.

3. D. Appleton Co., CDM1-IDEF, Model of the Common Data Model: CCS620141000, 15 May, 1985.

4. D. Appleton Co., Computer Program Development Specification (DS) for ICAM Integrated Support System (IISS) Configuration Item: NDML Precompiler: DS620141200, October 1984.

5. D. Appleton Co., Embedded NDML Programmer's Reference Manual: PRM620141200, March, 1985.

6. Softech, Inc., NTM Programmer's Guide: UM620140001, July, 1984.

7. Control Data Corp., Computer Program Development Specification (DS) for ICAM Integrated Support System (IISS) Configuration Item: NDDL Command Processor: DS620141100, June 1985

2.2 Terms and Abbreviations

Attribute Use Class: (AUC)

Conceptual Schema: (CS)

Common Data Model Processor: (CDMP)

Common Data Model: (CDM) Describes common data application process formats, form definitions, etc, of the IISS and includes conceptual schema, external, internal schemas, and schema transformation operators.

Data Field: (DF) An element of data in the external schema. It is by this name that an NDML programmer references data.

Database Management System: (DBMS)

Distributed Request Supervisor: (DRS) This IISS CDM subsystem configuration item controls the execution of distributed NDML queries and non distributed updates.

Domain: A logical definition of legal attribute class values.

SECTION 3

REQUIREMENTS

3.1 Structural Description

The graphic portrayal of this CPCI is included in Section 3.10. This chart shows the hierarchical relationship of each module making up this CPCI.

This CPCI uses a lower level module to identify complete internal schema primary or secondary keys in the NDML request (CDPR7KY).

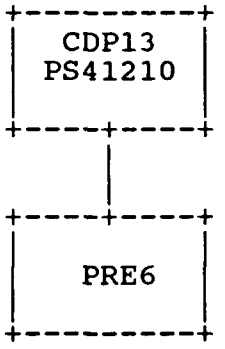
3.2 Functional Flow

This CPCI implemented the logic defined as PRE6 in the Development Specification for this CPCI. Details of inputs/outputs and relationships between modules are found in Section 3.10.

This CPCI has been designated to operate in a batch or interactive mode. It must operate in the system environment established for IISS; that is, the Network Transaction Manager. The ORACLE DBMS installed on a DEC VAX computer must be used.

3.3 Interfaces

The following diagram depicts the interface of PRE6 with other CPCI's in the system.



3.3.1 Inputs/Outputs

The following table depicts the inputs and outputs of this CPCI. A detailed description for each item can be found in the DS for this CPCI.

3.8 Object Code Creation

The object code for this CPCI will be created by the system integration team using defined IISS Software Configuration Management Procedures. This CPCI will use the COBOL language compiler.

3.9 Adaptation Data

This CPCI has been coded using ANSI COBOL language. The intent was to provide a transportable system. Any system environment supporting this language, a virtual memory management schema, the COMM and NTM subsystems of IISS and the ORACLE Database Management System should be able to support this CPCI. Every possible attempt has been made to localize and identify any machine or environment dependent modules through the original design of the IISS and application of Configuration Management Procedures.

3.10 Detail Design Description

The following sections have been computer generated for this CPCI.

3.10.2 Where External Routine Used List

The following lists each external function or routine in the documentation group and all the documented modules which call it. The purpose of each module is listed as well.

DOCGROUP PS41251 Where-external-routine-used List

System Module	Module Name
SQLSCA	
	CDDBTP
SQLBS1	
	CDDBTP
SQLSCH	
	CDDBTP
SQLSCC	
	CDDBTP
SQLTFL	
	CDDBTP
SQLOPN	
	CDDBTP
SQLOSQ	
	CDDBTP
SQLADR	
	CDDBTP
SQLAB1	
	CDDBTP
SQLEXE	
	CDDBTP
SQLAD1	
	CDDBTP
SQLFCH	
	CDDBTP
ERRPRO	
	CDDBTP
	CDPRE7
RPTERR	
	CDPRE7

3.10.4 Module Documentation

The following documentation describes information which is specific to each individual module in the documentation group being documented in this specification. It provides a compact way of getting information that would be otherwise buried within each module's source code.

The specific items in this module documentation have the following meanings:

NAME:	Name of program Module.
PURPOSE:	Purpose of Module as detailed in the source code.
LANGUAGE:	Programming language source code is written in. The choices are: VAX-11 FORTRAN C (I/S-1 Workbench 'C') VAX-11 COBOL
MODULE TYPE:	Whether a Program, Subroutine, or Function.
SOURCE FILE:	Name of Source File from file specification.
SOURCE FILE TYPE:	Source File Extension from file specification.
HOST:	Whether this is a host-dependent routine (VAX or IBM) or blank if host-independent.
SUBSYSTEM:	IISS sub-system this file resides in.
SUBDIRECTORY:	Sub-directory of that subsystem in which this file resides.
DOCUMENTATION GROUP:	Name of documentation group of which this source file is a member.
DESCRIPTION:	A description of the module as otained from the source code.
ARGUMENTS:	The arguments with which this routine is called if it is a Subroutine or a Function.
INCLUDE FILES:	A list of all the files that are included into this module as well as their purposes.
ROUTINES CALLED:	Subroutines or Functions, either documented or external, called by this module, if any.

CALLED DIRECTLY BY: The documented routines which call this module, if any.

USED IN MAIN PROGRAM(S): The documented Main Programs which contain this module in their parts list according to the list in section 3.10.3.

The Module Documentation is arranged alphabetically according to Module Name.

DOCGROUP PS41251 Module Documentation

```
NAME: CDDBTP
PURPOSE: SEARCH FOR DB SPECIFIC ATTRIBUTES
LANGUAGE: VAX-11 COBOL
SOURCE FILE: CDDBTP
SOURCE FILE TYPE: PCO
HOST:
SUBSYSTEM: CDM
SUBDIRECTORY: NDML

DESCRIPTION:
------------
-
CDDBTP WILL SUPPLY CDM INFORMATION ABOUT A DATA BASE
GIVEN THE DB_ID.
MOD FOR REL 2.0:
STANDARDIZE ERROR HANDLING AND ADD SCHEMA NAMES AND
DB PASSWORD.  COMBINE INTO ONE SQL STATEMENT WITH
OUTER JOIN.
MOD FOR REL 2.3:
REWRITE TO USE EMBEDDED SQL AND PRECOMPILER.  REMOVE
REFERENCE TO THE CDM TABLE DBMS_COPY_LIBRARY.
MOD 3/30/89:
CHANGED SQL STATEMENT TO REMOVE OUTER-JOIN '(+)' TO MAKE
STANDARD SQL.  THE ORACLE SQL STATMENT REPLACED WAS:
'SELECT A.DBMS_NAME, A.HOST_ID, A.DB_NAME,
B.SCHEMA_NAME, B.SUBSCHEMA_NAME, B.DB_LOCATION
C.DB_PASSWORD,
A.CHARACTER_NULL, A.INTEGER_NULL, A.NTM_DIRECTORY
INTO    .
...
FROM    DATA_BASE A,
SCHEMA_NAMES B,
DB_PASSWORD C
WHERE   A.DB_ID = B.DB_ID (+) AND
A.DB_ID = C.DB_ID (+) AND
A.DB_ID = :DB-ID-WS'
```

ARGUMENTS:

INPUT-DBID	DSPLY[9(5)]
DBMS-NAME	DSPLY[X(30)]
HOST-ID	DSPLY[XXX]
DB-NAME	DSPLY[X(30)]
SCHEMA-NAME	DSPLY[X(30)]
SUBSCHEMA-NAME	DSPLY[X(30)]
DB-LOCATION	DSPLY[X(30)]
DB-PASSWORD	DSPLY[X(30)]
CHARACTER-NULL	DSPLY[X(30)]
INTEGER-NULL	DSPLY[X(30)]
NTM-DIRECTORY	DSPLY[X(2)]
RET-STATUS	DSPLY[X(5)]

INCLUDE FILES:

CHKCDM
ERRCDM
EOD
ERRPRO

ROUTINES CALLED:

SQLSCA
SQLBS1
SQLSCH
SQLSCC
SQLTFL
SQLOPN
SQLOSQ
SQLADR
SQLAB1
SQLEXE
SQLAD1
SQLFCH
ERRPRO

DOCGROUP PS41251 Module Documentation

NAME: CDPRE7
PURPOSE: TRANSFORM AN IS ACCESS PATH TO GENERIC CODASYL
LANGUAGE: VAX-11 COBOL
SOURCE FILE: CDPRE7
SOURCE FILE TYPE: COB
HOST:
SUBSYSTEM: CDM
SUBDIRECTORY: NDML

DESCRIPTION:

- TRANSFORM AN ACCESS PATH TO GENERIC CODASYL
SPR 433- SM2 SHOLD GENERATE IRN, NOT IRF
SPR 731- RIJ, SPC mnemonics added for record outer join

-

ARGUMENTS:

FCB-E	DSPLY[S9(9)]
ACCESS-PATHS	RECRD
RECORD-KEY-TABLE	RECRD
GC-TABLE	RECRD
RET-STATUS	DSPLY[X(5)]

INCLUDE FILES:

ERRCDM
ERRFS
INSTTBL
APAT
APRK
APGC
ERRPRO

ROUTINES CALLED:

RPTERR
ERRPRO

3.10.5 Include File Descriptions

The following list contains a purpose and description of each include file in the documentation group as specified in the source code. The language it is written in is also given.

DOCGROUP PS41251 Include File Description

FILE NAME: APAT
PURPOSE: ACCESS PATH TABLE
LANGUAGE: VAX-11 COBOL

DESCRIPTION:

CONTAINS THE ACCESS PATH FOR ONE SUBTRANSACTION FOR A NDML REQUEST.

DOCGROUP PS41251 Include File Description

FILE NAME: APGC
PURPOSE: GENERIC CODASYL COMMAND TABLE
LANGUAGE: VAX-11 COBOL

DESCRIPTION:

HOLDS THE GENERIC CODASYL DML COMMANDS FOR AN ACCESS PATH OF AN NDML REQUEST

DOCGROUP PS41251 Include File Description

FILE NAME: APRK
PURPOSE: TABLE OF RECORD KEYS FOR CODASYL ACCESS PATHS
LANGUAGE: VAX-11 COBOL

DESCRIPTION:

CONTAINS INFORMATION FOR THE KEYS OF RECORDS CONTAINED IN THE CURRENT ACCESS PATH

DOCGROUP PS41251 Include File Description

FILE NAME: CHKCDM
PURPOSE: IISS CDMP CHECK STATUS CODES
LANGUAGE: VAX-11 COBOL

DESCRIPTION:

CONTAINS ALL STATUS CODES FOR THE *
CDMP MODULES *

DOCGROUP PS41251 Include File Description

FILE NAME: EOD
PURPOSE: SQL END OF DATA DEFINITION
LANGUAGE: VAX-11 COBOL

DESCRIPTION:

DOCGROUP PS41251 Include File Description

FILE NAME: ERRCDM
PURPOSE: IISS ERROR STATUS CODES FOR CDMP MODULES
LANGUAGE: VAX-11 COBOL

DESCRIPTION:

CONTAINS ALL ERROR CODES USED BY CDMP *
MODULES FOR ERROR HANDLING *

DOCGROUP PS41251 Include File Description

FILE NAME: ERRFS
PURPOSE: ERRFS.INC - FILE I/O PRIMITIVES (FILE SERVICES)
LANGUAGE: VAX-11 COBOL

DESCRIPTION:

IISS ERROR CODES

THIS FILE DEFINES THE FS STATUS
CODES IN COBOL FORMAT

DOCGROUP PS41251 Include File Description

FILE NAME: ERRPRO
PURPOSE: PROCESS ERROR INCLUDE FILE
LANGUAGE: VAX-11 COBOL

DESCRIPTION:

DOCGROUP PS41251 Include File Description

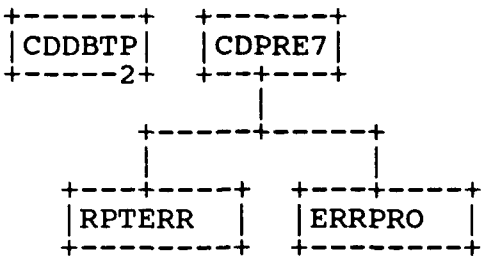
FILE NAME: INSTTBL
PURPOSE: TABLE CONTAINING ALL GENERIC CODASYL COMMANDS
LANGUAGE: VAX-11 COBOL

DESCRIPTION:

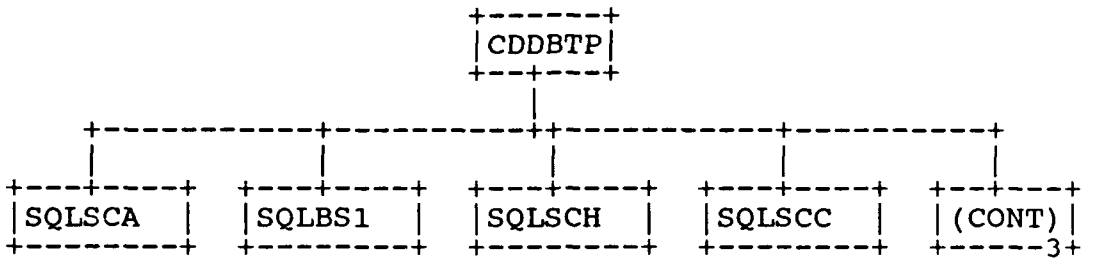
DECODE FOR THE GENERIC CODASYL COMMANDS

3.10.6 Hierarchy Chart

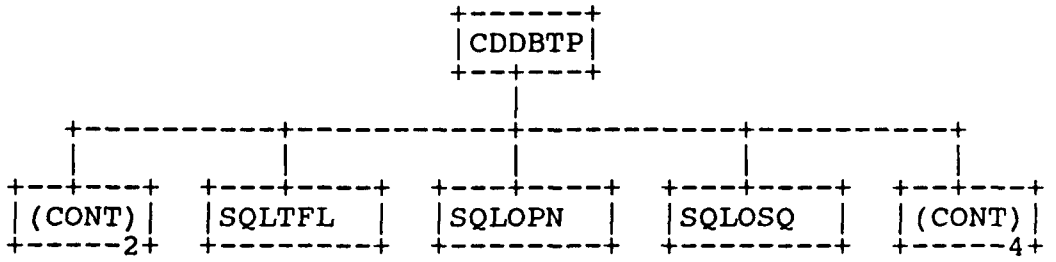
1



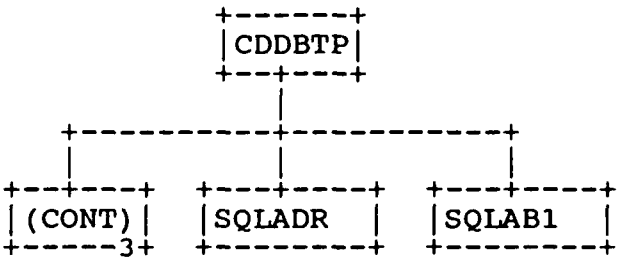
2



3



4



CDDBTP.....2
CDPRE7.....1
ERRPRO
RPTERR
SQLAB1
SQLADR
SQLBS1
SQLOPN
SQLOSQ
SQLSCA
SQLSCC
SQLSCH
SQLTFL

3.11 Program Listings Comments

This information is contained in the Module Descriptions in section 3.10.

SECTION 4

QUALITY ASSURANCE PROVISIONS

4.1 Introduction and Definitions

"Testing" is a systematic process that may be preplanned and explicitly stated. Test techniques and procedures may be defined in advance, and a sequence of test steps may be specified. "Debugging" is the process of isolation and correction of the cause of an error.

"Antibugging" is defined as the philosophy of writing programs in such a way as to make bugs less likely to occur and when they do occur, to make them more noticeable to the programmer and the user. In other words, as much error checking as is practical and possible in each routine should be performed.

4.2 Computer Programming Test and Evaluation

The quality assurance provisions for test consists of the normal testing techniques that are accomplished during the construction process. They consist of design and code walk-throughs, unit testing, and integration testing. These tests are performed by the design team. Structured design, design walk-through and the incorporation of "antibugging" facilitate this testing by exposing and addressing problem areas before they become coded "bugs."

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